the family are given concisely, as well as the more interesting features of the history, distribution, and uses of the more important economic representatives.

The book is written in attractive style, and the material is well selected, and is a commendable effort to differentiate secondary-school botany from university botany. The numerous half-tones are of unusually good quality.

MARTIN[2] has attempted the same task, except that his book is more specifically directed to the botanical needs of the student of agriculture. The first part deals with flowers, seeds, cells, roots, stems, buds, leaves, etc. The application to agriculture consists chiefly in the fact that economic plants are used as illustrative material. For example, oats, corn, wheat, pineapple, tomato, etc., are made to show the usual fundamental facts of morphology. The second part presents an outline of the plant kingdom, from Thallophytes to Angiosperms, along with chapters on ecology, evolution, heredity, and plant breeding.

The presentation throughout is botanical rather than agricultural, a foundation for agricultural study rather than a study of agriculture. The line drawings are not as well done or as accurate as they should be, and the illustrations in general are in contrast with the excellent presswork and the easy and pleasing style of presentation.—F. L. STEVENS.

NOTES FOR STUDENTS

Physiology of dormancy.—Recent work by CROCKER and HARRINGTON[3] materially increases our knowledge of the physiology of dormancy and germination of seeds, and throws much light on the problems of vitality and respiration. Differences in the optimum temperature requirements for germination of Johnson grass and Sudan grass led to a study of their physiological differences, and a comparison of their behavior with seeds of widely separated groups of plants. The discussion therefore is a general contribution of much significance to seed physiology. The study centers in the relation of catalase content to dormancy and vitality. Some improvements in methods of measuring catalase activity are suggested, chief of which is neutralization of the hydrogen peroxide used, as it is found to be injuriously acid if unneutralized. Degree of pulverization must be considered, as seeds vary somewhat as to optimum degree of fineness. Bolting cloth of 70–100 mesh gave the best results in the seeds used. Material must also be freshly ground, as degeneration of catalase is rapid after destruction of morphological integrity.

Catalase activity is found to be 28 or 29 times as great in the embryo of Stoner wheat as in the endosperm. Sudan grass and a hybrid between Tunis grass and sorghum gave similar results. Bracts surrounding the caryopses,

[2] MARTIN, J. N., Botany for agricultural students. 8vo. pp. xv+585. *figs. 488*. New York: John Wiley & Sons. 1919.

[3] CROCKER, WM., and HARRINGTON, G. T., Catalase and oxidase content of seeds in relation to their dormancy, age, vitality, and respiration. Jour Agric. Research 15:137–174. 1918.

however, and sterile florets show very low activity, especially after a year of dry storage. It is suggested that in these cases, where presumably dead tissues give catalase reaction, the activity is a residuum of previous physiological activity. In the grasses, catalase activity decreases continuously from the time the seeds are harvested. This decrease, however, is in no way connected with loss of vitality. Even when the activity has fallen to one-half or one-third of the fresh harvested material, there may still be practically complete vitality, and but slight loss in vigor. The investigation indicates that under certain conditions catalase activity might be used to estimate the age of seeds. It would only be necessary to know the normal rate of activity decrease, to be sure that no accidental destruction of catalase activity had occurred, and to use proper controls of materials of known age and of equal maturity with the seed to be tested.

When dormancy occurs in grasses it is usually caused by seed coat characters. Thorough drying at about 20° C. is the best after-ripening condition, but during drying catalase activity is falling rapidly. Seeds of *Amaranthus retroflexus* also have a dry after-ripening period, but in these the catalase is time-stable, and very little decrease in catalase activity occurs during drying. In contrast to these there are other seeds, as peach, linden, and hawthorn, where dormancy is due to embryo conditions, in which after-ripening, which depends mostly on cool temperature and moisture, is accompanied by a rapid increase in catalase activity and other fundamental time-requiring chemical changes. Such chemical changes, aside from catalase decrease, do not occur in the grasses. Heating air-dry seeds finally reduces both vitality and catalase activity, but the denaturing of the catalase and the proteins upon which viability depends does not run parallel. Catalase decrease commences at once; but viability may increase temporarily, and then decrease to zero before the catalase is destroyed. In other cases viability is soon lost, but catalase activity remains high, as in *Amaranthus*.

Seeds of Johnson grass kept in a germinator at room temperature undergo secondary dormancy and lose their catalase activity rapidly. The respiratory activity falls correspondingly. If these conditions are repeated in seeds buried in the soil, they may have an important bearing on the longevity of buried seeds. If death depended upon destruction of food supply by respiration, decreased respiration would provide longevity. When seeds of Johnson grass germinate, there is a very rapid increase again in the catalase activity. At every point it seems that catalase activity and respiration intensity run parallel. Some tests of oxidase activity were made with the same seeds, and it is shown that oxidase activity decreases with age. Little relation was found between oxidase and after-ripening changes in grasses or peach seeds, and oxidase activity showed no increase in germination, but in those non-living parts, bracts and scales, where catalase activity was low, oxidase activity was relatively high. The oxidase of Johnson grass and the Tunis grass-sorghum hybrid is only slightly sensitive to mercuric chloride poisoning.

Another paper by the same authors[4] describes some experiments made to test the effects of desiccation on vitality of seeds. The seeds of grains and grasses will withstand drying to less than 1 per cent without material loss in germination. Blue grass and Johnson grass can even be dried to 0.1 per cent of moisture without loss in germination, but vigor is greatly reduced in the blue grass. Still further loss of vigor occurred in the blue grass when dried in vacuo at 100° C. for 6 hours, but the germination percentage was not materially reduced. These results negative the statements of EWART that excessive drying changes dormant protoplasm to such an extent that the essential molecular groupings cannot be re-established under conditions for germination.—C. A. SHULL.

Curing timber.—A method of drying timber more uniformly to avoid cracks and shakes in the logs is proposed by STONE.[5] The method is based upon assumptions as to the natural movement of sap in trees which will not meet with favor among plant physiologists. He considers that the water is held in the saturated tracheal walls, evaporates from these walls into continuous vapor-filled lumina, and moves upward through the tubes in response to a partial vacuum produced above by transpiration. Indeed, the water is supposed to travel upward mostly by night, because at that time the leaves are much cooler than the trunk, and would condense the vapor from the tubes, thus filling the cells as reservoirs against the next day's transpiration. Salts are imagined to travel through the cell walls of the tracheae rather than in the transpiration stream, which is nonexistent in STONE's assumption. It is hard to imagine a conception much more at variance with experimental results of physiological studies.

The actual drying plant suggested is a closed shed, arranged with a cooler at one end, the purpose of which is to condense the moisture as it leaves the logs, in the form of hoar frost, on the principle of the dew pond. Thus the air of the shed will be kept continually dry, and cold dry air constantly circulating through and around the porous logs. He asserts that this would dry each annual layer simultaneously, and that the shrinkage would be regular and occur without cracking. Whether the proposed plant would really result in the uniform curing of timber the reviewer must leave to the practical forester. Perhaps the suggestion is much sounder on the practical side than the assumptions on which it is based would seem to indicate.—C. A. SHULL.

Philippine plant diseases.—REINKING[6] has published an excellent and very useful account of the economic plant diseases of the Philippines, which

[4] HARRINGTON, G. T., and CROCKER, WM., Resistance of seeds to desiccation. Jour. Agric. Research **14**:525–532. 1918.

[5] STONE, HERBERT, The ascent of the sap and the drying of timber. Quart. Jour. Forestry **12**:261–266. 1918.

[6] REINKING, OTTO A., Philippine economic plant diseases. Philipp. Jour. Sci. **13**:165–274. *pls. 20. figs. 43.* 1918.